PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application Of: Johan O. A. Robertsson James E. Martin	Group Art Unit: 3663
Serial No.: 10/501,125	Examiner: Scott Hughes
Filed: 2/14/05	Atty. Dkt. No.: 2088.006300
For: Method And Apparatus For Processing Seismic Data	Client Docket: 14.0198-PCT-US
	Conf No: 5567

RESPONSE TO OFFICE ACTION DATED MARCH 17, 2006

Customer No.: 23720

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Sir:

This paper is submitted in response to the Office Action dated March 17, 2006 for which the three-month date for response is June 17, 2006.

Amendments to the Claims begin on page 2 of this page.

Remarks/Arguments begin on page 6 of this page.

It is believed that no fee is due; however, should any fees under 37 C.F.R. §§ 1.16 to 1.21 be required for any reason, the Director is authorized to deduct said fees from Williams, Morgan & Amerson, P.C. Deposit Account No. 50-0786/2088.006300.

Reconsideration of the application is respectfully requested.

AMENDMENT

This listing of claims will replace all prior versions, and listing, of claims in the application.

1. (Original) A method of processing acoustic data acquired at a receiver, the method comprising the steps: of processing the acoustic data to obtain at least a down-going component of a parameter of the acquired acoustic data; and using at least the down-going component of the parameter to identify the direct arrival at the receiver of acoustic energy emitted by a source.

2. (Original) A method as claimed in claim 1 and comprising the step of identifying, in the down-going component of the parameter, the direct arrival at the receiver of acoustic energy emitted by a source.

3. (Previously Presented) A method as claimed in claim 1, wherein the parameter of acoustic data is pressure.

4. (Original) A method as claimed in claim 3 and comprising determining the down-going component of the pressure from the pressure acquired at the receiver and from either the vertical component of the particle motion acquired at the receiver or the vertical component of the pressure gradient acquired at the receiver.

5. (Previously Presented) A method as claimed in claim 1, wherein the parameter of acoustic data is the vertical component of particle motion acquired at the receiver or is the vertical component of the pressure gradient acquired at the receiver.

6. (Original) A method as claimed in claim 5 and comprising determining the down-going component of the vertical component of particle motion from the pressure acquired at the receiver and from either the vertical component of the particle motion acquired at the receiver or the vertical component of the pressure gradient acquired at the receiver.

7. (Previously Presented) A method as claimed in claim 4, wherein the vertical component of particle motion is the vertical component of particle acceleration.

8. (Previously Presented) A method as claimed in claim 4, wherein the vertical component of particle motion is the vertical component of particle velocity.

9. (Currently Amended) A method as claimed in claim 3, wherein the step of determining the down-going component of the pressure comprises determining:

$$P^D = \frac{1}{2}\left(P - \frac{\rho a}{\sqrt{k_a^2 - k_x^2 - k_y^2}} v_z\right) \qquad \cancel{(1)}$$

where P is the pressure acquired at the receiver, $\underline{v_z}$ ~~v_c~~ is the vertical component of particle velocity acquired at the receiver, ρ is the density of water, a is the angular frequency of the acoustic energy, $k_a = a / c_a$ is the magnitude of the wavenumber for acoustic energy in the water, c_a is the velocity of acoustic energy in water, and k_x and k_y are horizontal wavenumbers.

10. (Original) A method as claimed in claim 1 and comprising processing at least the down-going component of the parameter of the acoustic data thereby to derive a further parameter of the acoustic data, and identifying in the further parameter, the direct arrival at the receiver of acoustic energy emitted by a source.

11. (Original) A method as claimed in claim 10 wherein the further parameter is the direct arrival wavefield.

12. (Previously Presented) A method as claimed in claim 1, further comprising the step of determining the path length of acoustic energy from the source to the receiver from the direct arrival of acoustic energy at the receiver.

13. (Original) A method as claimed in claim 12 wherein the source is spatially separated from the receiver, and wherein the path length of seismic energy from the source to the receiver is indicative of the separation between the source and the receiver.

14. (Original) A method as claimed in claim 12 wherein the source is proximate to the receiver, and wherein the path length of seismic energy from the source to the receiver is indicative of the range from the source and receiver to a reflector of acoustic energy.

15. (Previously Presented) A method of seismic surveying comprising: actuating a source of acoustic energy to emit acoustic energy; acquiring acoustic data at a receiver; and processing the acoustic data according to a method as defined in any of claims 1 to 3, 5, 10, and 12.

16. (Original) An apparatus for processing acoustic data acquired at a receiver, the apparatus comprising: means for processing the acoustic data to obtain at least a down-going component of a parameter of the acoustic data; and means for identifying the direct arrival at the receiver of acoustic energy emitted by a source, using at least the down-going component of the parameter.

17. (Original) An apparatus as claimed in claim 16 and wherein the means for identifying the direct arrival are adapted to identify the direct arrival in the down-going component of the parameter.

18. (Currently Amended) An apparatus as claimed in claim 16 and comprising means for processing at least the down-going component of the parameter of the acoustic data thereby to derive a further parameter of the acoustic data; ~~and d,~~ and wherein the means for identifying the direct arrival are adapted to identify the direct arrival in the further parameter.

19. (Previously Presented) An apparatus as claimed in claim 16, further comprising means for determining the path length of acoustic energy from the source to the receiver from the direct arrival of acoustic energy at the receiver.

20. (Previously Presented) An apparatus as claimed in claim 16, comprising a programmable data processor.

21. (Original) A storage medium containing a program for the data processor of an apparatus as defined in claim 20.

22. (Previously Presented) A seismic surveying apparatus comprising: a source of acoustic energy; a receiver spatially separated from the source; and an apparatus as defined in any of claims 16 to 20 for processing acoustic data acquired at the receiver.

23. (Original) A ranging apparatus comprising: a source of acoustic energy; a receiver located proximate to the source; and an apparatus as defined in any of claims 16 to 20 for processing acoustic data acquired at the receiver.

REMARKS

Claims 1-23 are pending in the case. The Office Action rejected each of claims 1-23 on various grounds and objected to claims 9 and 18. More particularly, the Office Action rejected:

- claims 1-6, 8-11, 15-18, and 22-23 as anticipated under 35 U.S.C. § 102(a) and 35 U.S.C. § 102(b) by Yan Yan & R. James Brown, "Suppression of Water-Column Multiples by Combining Components of OBS Surveys", 13 CREWES Research Report 321 (2001) ("Yan (2001)");
- claim 7 as obvious under 35 U.S.C. § 103 (a) over Yan (2001);
- claims 12-14 and 19 as obvious under 35 U.S.C. § 103 (a) over Yan (2001) or Yan Yan & R. James Brown, "Suppression of Multiples by Wavefield Separation Techniques", 12 CREWES Research Report 1 (2000) ("Yan (2000)") in combination with U.S. Letters Patent 6,314,371 ("Monk")[1]; and
- claims 20-21 as obvious under 35 U.S.C. § 103 (a) over Yan (2001) or Yan (2000) in combination with U.S. Letters Patent 5,696,734 ("Corrigan").

Applicant has cured the objections by amendment above and traverses each of the rejections.

I. INFORMALITIES

The objections to claims 9 and 18 have been cured by amendment above. Applicant notes that the amendments were not made for purposes of patentability and do not narrow the scope of the claim. Applicant submits that the objections are now moot and requests that they be withdrawn.

The Office Action notes certified copies of the priority documents have been received. Applicant therefore believes the claim to priority to have been perfected. Applicant requests notification should this not be the case.

II. SUBSTANTIVE MATTERS

A. The Office Failed to Establish that Yan (2001) is "Prior Art"

[1] Monk is not prior art to Applicant's invention. Applicant's priority date is January 11, 2002. Monk was patented in November 2001. Monk is therefore only citable under the legal fiction employed by the Office that it *prima facie* evidences activities by others prior to Applicant's invention, assuming that Applicant's filing date is the date of invention. Applicant reserves the right to swear behind Monk at a later date should he wish to do so.

As a preliminary matter, Applicant notes that Yan (2001) does bear the date "2001", but there is no indication of what event occurred in 2001. It may be the date the report was finalized. It does not necessarily reflect when the report when it was published, when it was posted to the CREWES website, or when the information was otherwise made publicly known. In short, on its face, Yan (2001) merely establishes that some event associated with it occurred in 2001. The Office has failed to produce any evidence of what occurred in 2001, and therefore has failed to demonstrate that Yan (2001) is prior art.

Applicant's priority date is January 11, 2002, which means that Yan (2001) can only be prior art under 35 U.S.C. § 102 (b) if it was published, *etc.*, as set forth in the statute in the first ten days of 2001. Even if the application was, in fact, published in 2001, it is only prior art under 35 U.S.C. § 102 (b) if published *in the first ten days* of 2001. The Office has failed to establish that this happened. Thus, the Office has failed to establish that Yan (2001) is a proper reference under 35 U.S.C. § 102 (b).

Furthermore, the Office has failed to establish that it is prior art under 35 U.S.C. § 102 (a). Although this statute only requires certain activities prior to Applicant's invention, the Office has failed to establish that any of these activities actually occurred in 2001. For example, the Office failed to establish that Yan (2001) was printed in 2001. It may only have been drafted and finalized in 2001. There is no evidence that it was published in 2001. Even if one assumes that the 2001 evidences that the content of the report was known to CREWES, this is insufficient to establish that it was "known by others" as is required by 35 U.S.C. § 102 (a). *See Soundscriber Corp. v. United States*, 360 F.2d 954, 960 (Ct. Cl. 1966).

Thus, Applicant hereby expressly challenges the status of Yan (2001) as prior art to Applicant's invention. Since all rejections rely upon Yan (2001) in whole or in part, each of the rejections fails. Applicants nevertheless present argument against Yan (2001) because the Office has misconstrued it and it does not teach the limitations for which it is cited.

B. The Office Misconstrues Yan (2001)

All claim rejections rely in whole or in part on Yan (2000).[2] More particularly, all claim rejections rely on Yan (2000) to teach "using at least the down-going component of the

[2] The Detailed Action does state that claims 12-14 and 19 are alternatively rejected over Yan (2000) in combination with Monk, Yan (2000) being applied as applied to claims 1 and 16. However, the Office does not assert Yan

parameter to identify the direct arrival at the receiver of acoustic energy emitted by a source", as is recited in claim 1. (Note that all other claims either directly or indirectly refer to claim 1—even those that are independent.) However, as will be established below, Yan (2000) does not, in fact, teach this limitation.

In rejecting claims 1-6, 8-11, 15-18, and 22-23, the Office alleged that Yan (2000) anticipated these claims and taught the subject limitation, citing pp. 322, 341, and Figure 23. Applicants review of p. 322 fails to review any such teaching. The most relevant passage Applicant can find on p. 22 states:

> This paper will analyze the downgoing multiple attenuation on each of three recorded components (pressure, vertical velocity, and inline velocity) using wavefield-separation technique and describe how the source-side multiples can be further removed from the separated upgoing wavefield. Numerical data and real data examples are provided for illustration.

According to Yan (2000), as is shown in Figure 23 (also cited by the Office), a direct wave is a downgoing wave and is not a multiple. The only reference to downgoing waves in the quote passage is in the context of downgoing multiple attenuation. Thus, according to Yan (2000) itself, p. 322 does not teach anything relevant to identifying a direct wave.

Applicant notes that Yan (2000) does suggest that it considers the direct wave to be a downgoing multiple. On p. 330, Yan (2000) states that "[a]fter application of our wavefield-separation technique, given above, the upgoing wavefield can be obtained and downgoing multiples, such as the direct wave, receiver side multiples, and reverberations are sufficiently suppressed." However, even if the direct wave is considered a downgoing multiple, this passage and that on p. 322 quoted above do not impliedly or expressly teach actually identifying the direct arrival. They teach only that it may be suppressed along with the other downgoing multiples.

Figure 23 should be further considered in light of p. 341, which describes Figure 23. According to its caption, Figure 23 illustrates "[e]xamples of downgoing waves in OBS data." These waves include a direct wave, a reverberation, and receiver-side ghosts. On p.341, Figure 23 is described as follows:

(2000) against either claim 1 or claim 16. Thus, Applicant presumes this alternative rejection is a mistake on the part of the Office. If it is not a mistake, then the rejection lacks the particularity required by law to establish *prima facie* obviousness.

> The downgoing wavefield contains the direct wave, water-column reverberations, and receiver-side ghosts (Figure 23)…."

This is only a statement of the fact that the direct wave constitutes a part of the downgoing wavefield. There is no hint or suggestion, express or implied, that the technique in Yan (2000) teaches actually identifying that constituent part of the downgoing wavefield known as the "direct wave."

The passages of Yan (2000) relied upon by the Office in the rejections of the present claims therefore teach no more than the prior art discussed in Applicant's application, at ¶ 38 (as published):

> [0038] The pressure acquired at the receiver may be de-composed into its up-going component and its down-going component using suitable filters. A number of methods for separation of an acquired wave field into its up-going component and down-going component have been proposed, for example for attenuation of water-layer multiple reflections or to enhance primary reflection events. These separation methods consist essentially of applying a suitable filter to the acquired wave-field to obtain either the up-going or the down-going component.

Thus, Applicant respectfully submits that Yan (2000) fails to teach all the limitations as alleged by the Office.

Applicant furthermore directs the Office's attention to a passage of Yan (2000), beginning on p. 331 and continuing onto p. 332:

> Decomposition equations (24), (27), (30) and (33) all require an estimate of the elastic parameters of the sea materials. Estimation of seafloor wave propagation can be performed by amplitude-versus-offset (AVO) analysis (Amundsen and Reitan, 1995). Schalkwijk et al., (1999) also presented a method of estimating the elastic parameters by a two-step wavefield decomposition method. In their scheme, instead of going from the measured data directly to the end result – up and downgoing P and S waves – they use several intermediate decomposition results before coming to the final result and each intermediate result allows for the estimation of some unknown parameters.
>
> Using a similar technique, Osen et al., (1999) performed the estimation of elastic parameter by applying equations (24), (27), (30) and (33) to the transmitted direct wave. Assuming that no upgoing waves interfere with the transmitted direct wave within a certain time window and offset range, they estimate the seafloor

parameters from equations (24), (27), (30) and (33) by requiring that upgoing wavefield $U = 0$. For equation (24), when a single plane-wave propagates directly from the source to the receiver in a direction perpendicular to a horizontal sea bottom, this equation can be written as:

$$U^W(z_1^+) = \frac{1}{2}[W(z_1^-) - \rho\alpha V_3(z_1^+)] \tag{36}$$

The scaling factor between the pressure and vertical velocity in equation (36) equals the P-wave impedance of the seafloor materials (ρα). By comparing the zero offset trace for the direct wave on the hydrophone with the corresponding trace for the direct wave on the vertical geophone, an estimate of the impedance, ρα, can be obtained.

Note that this passage generally teaches the opposite approach of that recited in the claims. In this passage, Yan (2000) teaches estimation of a parameter from the direct wave for use in decomposition. In the present claims, however, the downgoing wavefield is decomposed to obtain the downgoing component of a parameter from which the direct wave is identified.

Thus, contrary to the Office's construction, not only does Yan (2000) fail to teach all the limitations of the claims, it teaches a generally opposite approach. An anticipating reference, by definition, must disclose every limitation of the rejected claim in the same relationship to one another as set forth in the claim. M.P.E.P. § 2131; *In re Bond*, 15 U.S.P.Q.2d (BNA) 1566, 1567 (Fed. Cir. 1990). To establish a *prima facie* case of obviousness, the prior art reference (or references when combined) must teach or suggest all the claim limitations. M.P.E.P. § 706.02(j); *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (CCPA 1974). The rejections of the claims, whether they are for anticipation or obviousness, therefore fail because Yan (2000) fails teach the limitations for which it is cited.

CONCLUDING REMARKS

Applicants therefore respectfully submit that the claims are in condition for allowance, and requests that they are allowed to issue. The Examiner is invited to contact the undersigned

attorney at (713) 934-4053 with any questions, comments or suggestions relating to the referenced patent application.

Respectfully submitted,

Date: June 13, 2006

/Jeffrey A. Pyle/
Jeffrey A. Pyle
Reg. No. 34,904
Attorney for Applicants

WILLIAMS, MORGAN & AMERSON

10333 Richmond Dr., Suite 1100
Houston, Texas 77042
(713) 934-4053 Ph